Apollo™

User's Manual for analyzers:
APOLLO-Boxes, Expander, Apollo-Sync-Hub

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© SINUS Messtechnik GmbH
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Preface

Thank you for choosing the product APOLLO ™ by SINUS Messtechnik GmbH. Please read this manual carefully before using the measuring system. We recommend you to perform several test measurements to get familiar with the instrument before using it for important measuring tasks. The manual includes the following signs to indicate important information:

NOTICE!	These are information on the efficient use and correct handling of the analyzer as well as additional information.

CAUTION!	These instructions shall avoid any hardware damages or dangers for users.

ATTENTION!	These instructions shall avoid any measurement mistakes, hardware damages etc.

Please feel free to contact us for any questions on the functionality and operation of the instrument. Direct your questions or catalogue requests as well as requests on spare parts and accessories to the following address:

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APOLLO™	SINUS Messtechnik GmbH
SAMURAI™	SINUS Messtechnik GmbH
μREMUS™	Caesar Datensysteme GmbH

1 Description of the hardware

APOLLO TM analyzers are high-precise professional systems for acoustic, vibrational and general engineering tasks based on the flexible APOLLO filtering processor by SINUS Messtechnik GmbH. Together with the software SAMURAI™ the APOLLO analyzers conform to the standards IEC 61672 Typ 1 (Sound Level Meter) and IEC 61260 Typ 1 (Frequency analyzer). They are even better regarding tolerance and frequency range.

The devices Soundbook and APOLLO-PCIe are described in seperate manuals. Here only the hardware APOLLO _Box and Soundbook_Expander are described in all available versions. The following table 1.1 shows the default scope of delivery.

Gerät	**APOLLO box**	**APOLLO EXPANDER**
Scope of delivery	USB-KABEL STD APOLLO-BOX (908240.7) APOLLO/HARMONIE Carrying Case (908250.3)	USB-KABEL LANG APOLLO BOX (908241.5) USB-KABEL KURZ EXPANDER (908239.2) Apollo SYNC-KABEL LANG (908243.1) Apollo SYNC-KABEL KURZ (908245.6) EXPANDER-NETZTEIL (908315.1)

Table 1.1: Collection of the default scope of delivery

1.1 APOLLO-Box und Soundbook-EXPANDER

Each APOLLO analyzer is a universal multichannel measuring system in combination with a controlling computer. Centerpiece is the APOLLO filtering processor providing the elementary functions of frequency weighting A, C, Z of a sound level meter conforming to standards as well as realtime filtering with filters of constant relative bandwith. The system operates in the frequency range from 0 Hz up to 80 kHz signal bandwith (center frequency of the highest 3rd-octave).

Figure 1.1: APOLLO-Box with 4 channels LEMO

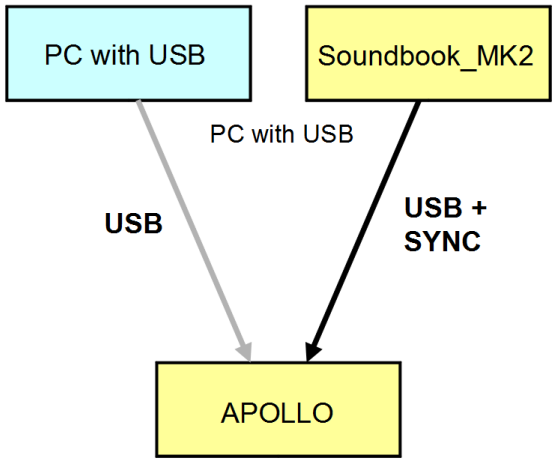

Figure 1.2: Scheme to operate a APOLLO analyzer with a PC or Soundbook MK2

Using the optional SYNC-HUB (section 1.2) up to 4 analyzers (APOLLO _Box and/or Soundbook_Expander) may be combined and synchronized working as one system under the software. With a Soundbook MK2 up to 40 synchronized channels can be reached on this way. For the adjustment to different measuring situations APOLLO _Box and Soundbook_EXPANDER are available in two types of construction:

- with BNC input sockets (only ICP power supply)

- with LEMO7 input sockets (ICP, symmetric power supply, Polarization voltage)

Figure 1.3: Soundbook MK2 with Expander

Figure 1.4: Expander as stand alone analyzer

The properties of the different APOLLO hardware versions are shown in table 1.2. Different software applications use the real time signal processing unit as automatic controlled analyzer (e.g.: SAMURAI ^{TM}, SMT^{TM}and μREMUS^{TM}). This conception provides a versatile programmable measuring system in connection with a PC.

APOLLO Version	**Box 4B**	**Box 4L**	**Box 2L**	**Box 4L+**	**Expander 8L**	**Expander 8B**
Reference number	908202.1	908200.5	908201.3	908204.6	908010.8	908011.6
Input channels	4 x BNC	4 x LEMO7	2 x LEMO7	4 x LEMO7	8 x LEMO7	8 x BNC
Powersupply*	500 mA			850 mA	1000 mA	
Transducer supply	ICP: 2 mA	Pol; ICP: 2 mA	Pol; ICP: 2 mA, 4 mA			ICP: 2 mA, 4 mA
Sampling frequency	200 Hz - 51,2 kHz		200 Hz - 204,8 kHz			

Table 1.2: Properties of the APOLLO analyzers for all available versions

Pol = $\pm$14 V as well as polarization voltage 20 V, 63 V, 200V available

ATTENTION! * Whether the required power can be provided by USB is to be checked in the specification of the driving PC. We recommend to use external power supply for all analyzers, that are delivered with an according mains adapter.

The sampling frequency and the transducer power supply are adjustable for each channel. The setting of the sampling frequency is done by doubling or decimation on the basis of: 44.1 kHz, 48 kHz oder 51.2 kHz.

The **APOLLO _Box** (figure 1.1) is connected to a PC via USB (figure 1.2) and run as independently working system with the SINUS-DRIVER. The **EXPANDER** may be used as expansion unit for Soundbook MK2 (figure 1.3) or as a separate analyzer like the APOLLO _Box connected to a PC (figure 1.4). To a Soundbook the EXPANDER is connected by two short cables, one connects the LEMO4 socket with USB of the PC and the other connects the SYNC sockets of both devices.

To a Laptop The EXPANDER has to be connected by the delivered LEMO-USB cable. To ensure sufficient power supply the expander has to be connected to the mains, too. For this connect the delivered power supply to the mains and put the LEMO-plug in the “Sync” socket of the EXPANDER.

NOTICE!	If and only if the USB slot of the PC supplies 1000 mA, it is possible to use the EXPANDER without external power supply.

1.1.1 Main Channels

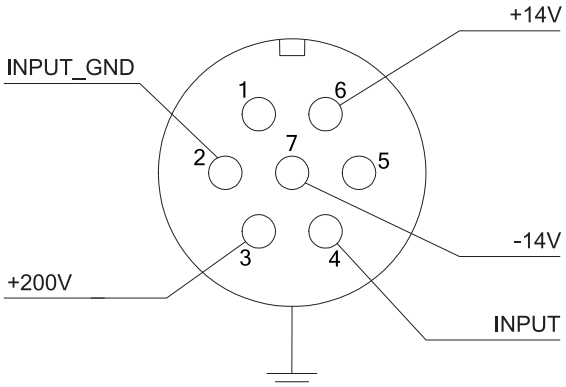

Figure 1.5: Main Channel socket assignment

The main channels offer to connect many different sensor types. Different kinds of voltage- and current supply are supported as well as a maximum bandwith of 80 kHz (table 1.2). Sensors may be calibrated by an external singnal on the main channels. Further details as time- and frequency weighting are given in table 2.1.

1.1.2 Trigger/Tacho

The **TRG** socket serves to monitor a signal and if so to activate a **Trigger** and if configured to send a trigger caused signal out. The trigger outputs are isolated switchable. For this the “TRG_OUT_COM” privides an own electrical mass. The trigger treshold is adjustable between $\pm$ 12.5 V. The trigger outputs may also be used as **Tacho** inputs. In this case a frequency is calculated from the incidence the trigger treshold is overcome. Using the optional Trigger-Splitterbox (figure 1.7) you may split the LEMO socket to individual BNC sockets. If desired the simple **Apollo Tachocable** [908185.7] is available, too.

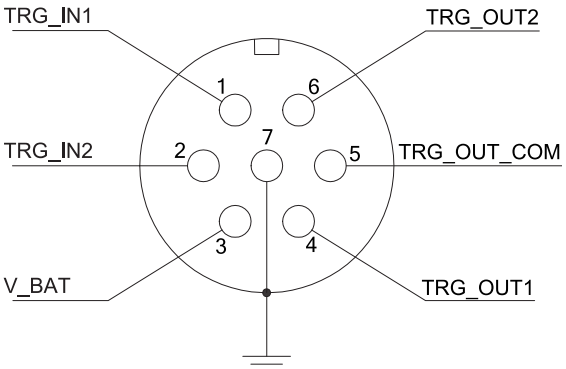

Figure 1.6: TRG socket assignment

Figure 1.7: Apollo Trigger-Splitterbox

1.1.3 Slow Channels

The **SLOW** socket provides 8 slow channels with a fixed sample rate of 200 Hz, that measns a bandwidth of 78.125 Hz. It serves to measure static or slowly changing signals or conditions. These channels optimal to connect sensors for pressure, force, temperature or similar values. With the optional Slow-Channel Splitterbox (figure 1.9) you may split the LEMO socket to individual BNC sockets.

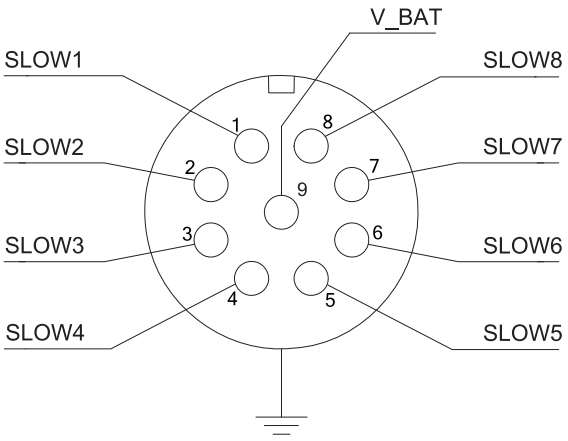

Figure 1.8: SLOW socket assignment

Figure 1.9: Apollo Slow Channel Box

1.1.4 Output

The output channels provide the signals of the internal generator. It is also possible to interconnect signals from the main channels to output. For example these as well as synthesized signals or signals which have been recorded to the hard disk may be given out during a running measurement. Via the Output-Cinch adaptercable [974158.6] you may connect headphones or loudspeakers. Using an additional Cinch-BNC adaptercable [974162.5] you may split the LEMO socket to individual BNC sockets (figure 1.11).

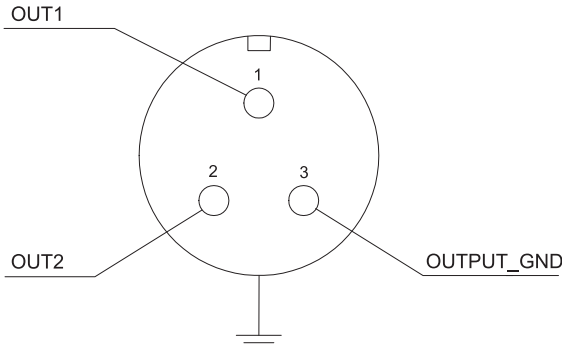

Figure 1.10: OUT 1/2 socket assignment

Figure 1.11: Output adapter cable

1.1.5 POWER/SYNC/GPS

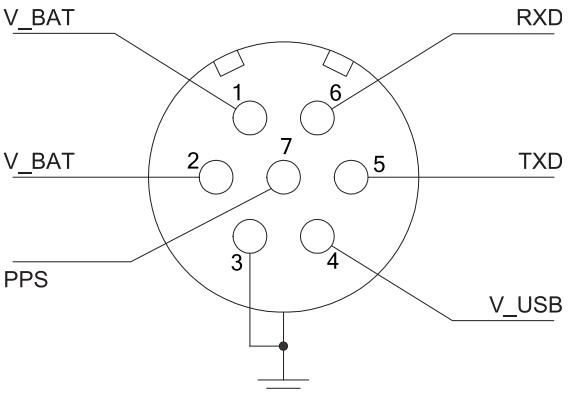

Figure 1.12: POWER/SYNC/GPS socket assignment

The **POWER/SYNC/GPS** socket mainly serves for the synchronisation of several APOLLO analyzers. It is also used to connect a GPS receiver. The "'V_Bat"' Pin provides power only in Soundbook MK2, not in APOLLO-Box or EXPANDER.

1.1.6 AUX

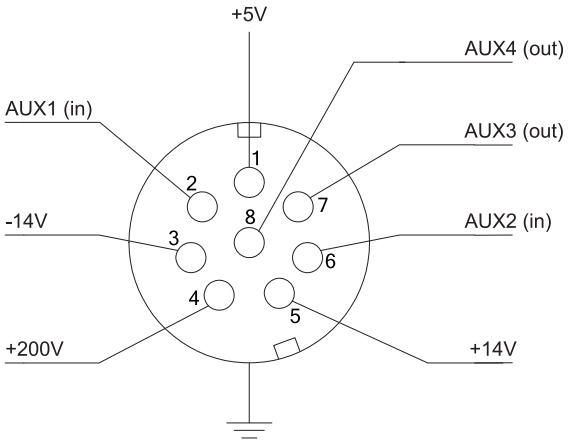

Figure 1.13: AUX socket assignment

The **AUX** socket serves for the connection of external devices like a remote control, a Soundintensity probe etc. The inputs are TTL. The outputs are switchable between 0 V and 3.3 V to drive LEDs for example.

1.2 APOLLO SYNC-HUB

The APOLLO allows you to connect up to four APOLLO analyzers to your computer and data synchronisation with Soundbook MK2 or GPS receiver. It is skeched out in figure 1.14. This concept provides a multi-purpose synchronized analyzer system. The power is supplied to the APOLLO by the LEMO-Buchsen on the front of the device. Four green Status LEDs at the front of the APOLLO indicate a successful set up of the Apollo_Boxen. The green LED at the top side turns bright when power is supplied to the APOLLO.

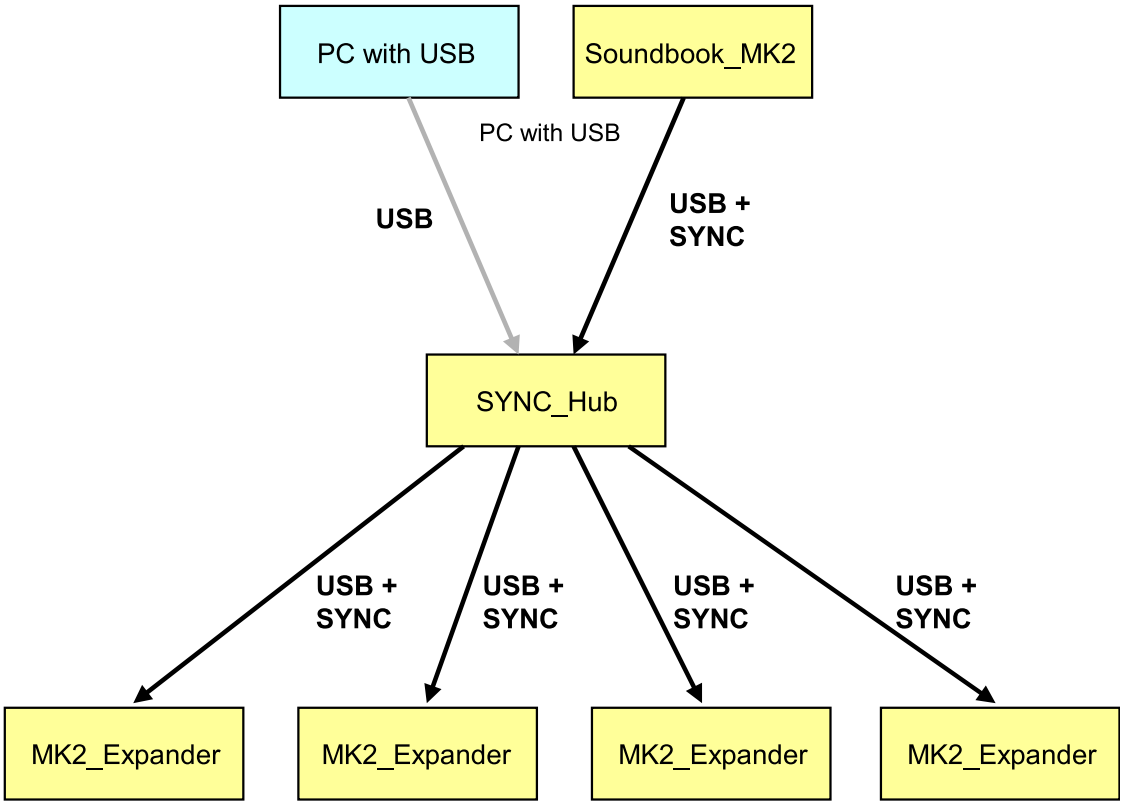

Figure 1.14: Scheme with APOLLO SYNC-HUB

1.2.1 Connectors

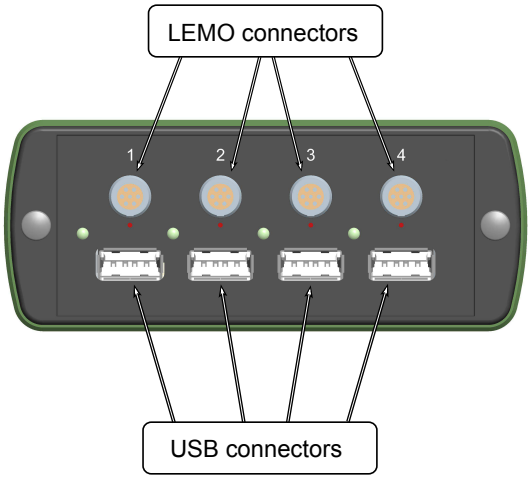

Figure 1.15: Connectors on the front

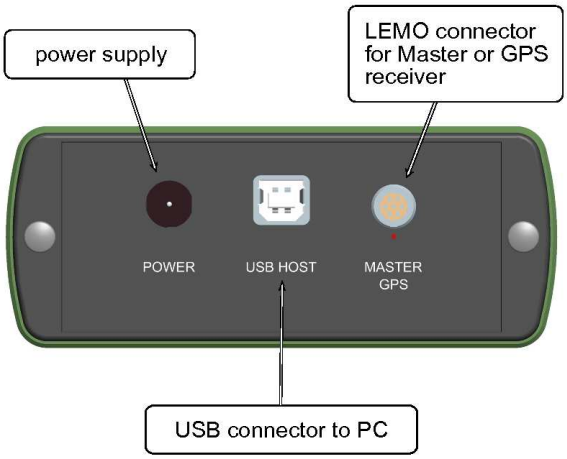

Figure 1.16: Connectors on the back

1.2.2 Hardware installation

1. Plug the included power adapter into the power jack found on the rear of the SYNC-HUB.
2. Plug the AC adapter into a wall outlet.
3. Plug the included USB cable into the USB jack on the rear of the device and your PC.
4. Connect your APOLLO with the USB and Sync cable to any of the four available ports on the front of the SYNC-HUB.
5. A green LED beside the port is turning bright after connecting an APOLLO.

1.2.3 Technical Specifications

General Data	
Power Supply	9 . . . 27 VDC, 3.5A (Center-pin positive)
Connectors on the front	4 x USB plug Type A 4 x LEMO
Connectors on the back	1 x DC jack for voltage supply 1 x USB Plug Type B 1 x LEMO
Max. Dimensions Weight	115 mm x 113 mm x 46 mm 420 g

1.2.4 Troubleshooting

If any problem persists, please contact SINUS Messtechnik GmbH.

1. *The indicator lamps on the front of the APOLLO doesn't illuminate after connecting an Apollo_Box.*
   Unplug the USB cable of the APOLLO and plug it again.

2. *The operating system notify an incorrect registration of an Apollo_Box after plugging/connecting.*
   If the indicator lamp beside the USB socket doesn't illuminate then unplug the USB cable of the APOLLO and plug it again.

3. The APOLLO analyzer is switched on and off (Status-LED is blinking).
If the APOLLO is connected to the back of the SYNC-HUB it must have an own power supply. Alternatively it may be connected to the front. Devices connected to the front may be used as Master, too.

1.3 Safety instructions

Please follow the instructions below when using the device:

- Use the device as described in this manual only.
- Despite the robust design protect the device from mechanical impacts and vibrations and keep it dry and clean.
- When using microphones please pay attention to the sensitive microphone membranes and avoid touching or moistening them.
- Do not feed the in- or outputs with voltages other than specified in this manual.
- Use only microphones which are intended for use with the device. Please feel free to contact us in any case of doubt.
- Please note the permissible ambient temperatures specified for the device.
- Do not expose the device to extreme heat as for example in a car under direct sunlight.
- If necessary, clean the device carefully without using solvents.
- If a malfunction occurs, do not attempt to disassemble or repair the device. This will always cause a loss of warranty and often lead to major damages. Please take down any failures and return the device together with a description of the failure.
- If service is required, always return the device to SINUS Messtechnik GmbH!

1.4 Commissioning of of an APOLLO analyzer

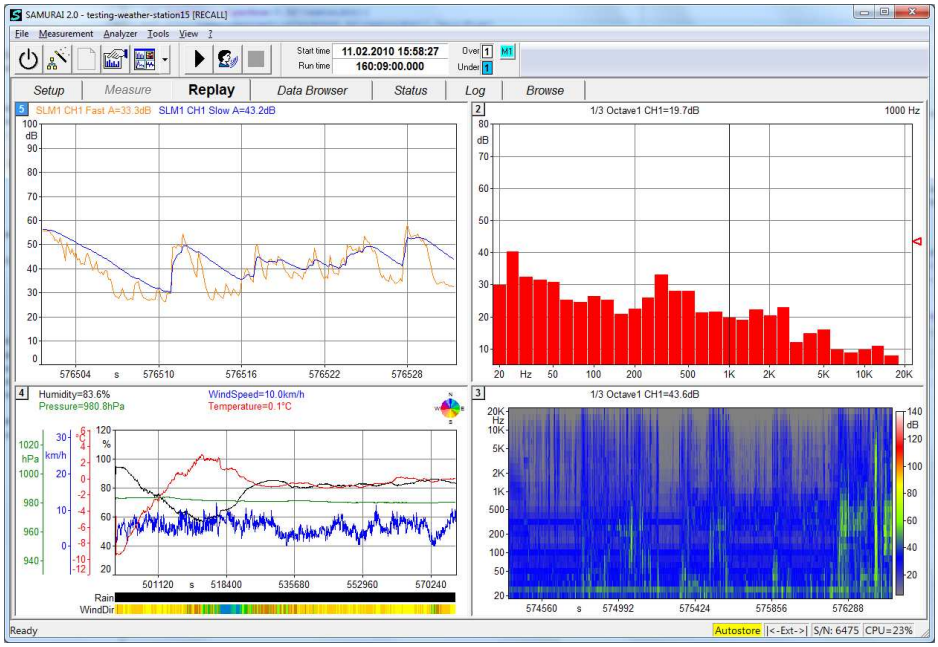

Figure 1.17: Typical application with APOLLO (SAMURAI)

Depending on your scope of delivery, SINUS Messtechnik GmbH has already installed the driver as well as the application software (siNoise/ SAMURAI/ si++ / μREMUS / SMT) and carried out a system check. If supplied without PC, software installation is performed by the user. You may, however, request one of our authorized representatives or distributors to set up your device at your expense.

You may connect the microphones, accelerometers and other transducers at any time, i. e. when APOLLO is running or turned off. When you have powered up the device, connected the transducers, started the measuring software and set the measuring channels, the device is ready for measuring. Please note that the supported operating systems (WinXP, Windows 7) allow simultaneous use of various applications. However, Windows is *no* real-time operating system. To rule out any complications during data acquisition we recommend to exit all unnecessary applications before starting signal acquisition. Please pay attention to the installed antivirus software also! Some applications may require or even force exiting unnecessary programmes.

1.5 Driver installation

You will find the installation programme on the enclosed CD or on the installation CD of the application software. The driver version is part of the file name (f. e. `SINUS_Driver 5.0.0.0.exe` → driver version: 5.0.0.0). After executing the installation file meassage window opens. Please verify that all APOLLO components are connected to the PC and click on **Ok**. After the welcome window showing the version number and the driver history window the installation procedure starts. Depending on the system performance this procedure may take a few minutes. Click on the button **Finish** to finish installation and exit the program. Having activated the corresponding checkbox, the **SINUS Driver Configuration** will start automatically. Otherwise it may be started via the given path with the start menu.

1.5.1 SINUS Driver Configuration

This tool is used for the configuration of the driver. The settings are described in table 1.3.

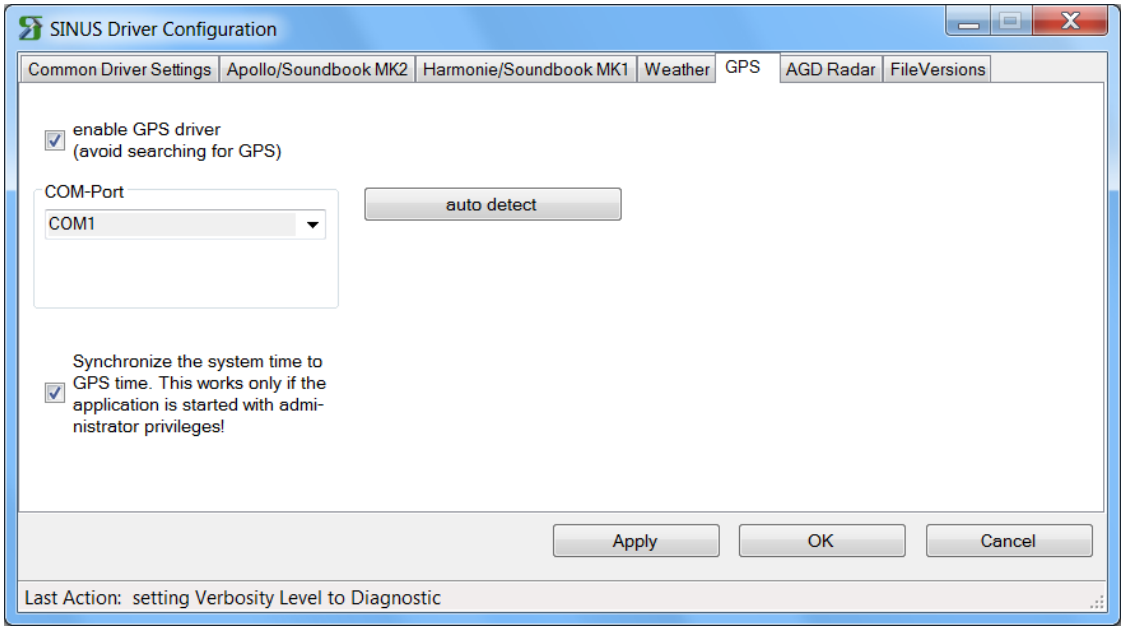

Figure 1.18: SINUS Driver Configuration

Tab	Description
Common Driver Settings	Adjustment of the Verbosity Level. It specifies how much information is written to the log-files. The possible values are described on the right.
Apollo/Soundbook MK2	Information about the detected Apollo/Soundbook MK2 analyzers (Refresh with F5 or via context menu).
Harmonie/Soundbook MK1	Information about the detected Harmonie/Soundbook MK1 analyzers (New Calibration via context menu).
Weather	Activation of the driver for the weather station. Select the type and the used port. The last one may be detected automatically (**autodetect**).
GPS	Aktivation of the driver for GPS devices connected via RS232. Select the used COM port. It may also be detected automatically (**autodetect**). If the measuring software is run as administrator, the GPS time synchronization every minute is available.
AGD Radar	Aktivation of the AGD Radar driver. Select the used port. It may also be detected automatically (**autodetect**).
File Versions	Overview of the installed parts of the driver and its status.

Table 1.3: Functions of the driver configuration tool

2 General technical data

All technical specifications refer to approved measurement microphones with a sensitivity of 50 mV/Pa.

Technical Specifications	
Number of channels:	2, 4 or 8 measuring channels
Accuracy:	According to IEC 61672-1 class 1, group Z, percentiles according to DIN 45657
1/3 octave filter:	Complying with EN 61260 class 1, 6 pole, elliptical, base 2
Max. drift of the internal time:	max. 1.728 ms in 24 h
Resolution:	24 Bit
Synchronization:	yes
Input channels	
Sampling rates:	200 Hz - 204.8 kHz possible (Basic: 44.1 kHz, 48 kHz, 51.2 kHz) see table 1.2
Gain:	0 dB, -20 dB
Frequency weighting:	A, C, Z simultaneously, see table 2.2
Time weighting:	F (Fast, $\tau = 0.125\ s$), S (Slow, $\tau = 1\ s$), I (Impulse, $\tau_{increase} = 0.035\ s, \tau_{decrease} = 1.5\ s$), peak ($\tau = 20\ \mu s$)
Crosstalk:	< -80 dB
Offset correction:	yes, at automatic calibration
Anti-alias Filter:	22.4 kHz @ 51.2 kHz
Overload display:	yes
Phase shift:	typical: 0.01° at 1 kHz
Input impedance:	1 MΩ
Input coupling:	DC, AC (HP with $f_g = 0.13$ Hz)
Input filter:	adjustable: non, 1 Hz HP, 10 Hz HP, 2000 kHz LP, 1-2000 Hz BP, 10-2000 Hz BP
Transducer supply (per channel):	$\pm$ 14 V; polarization voltage 20 V, 63 V or 200V; ICP: 2 mA (also 4 mA with Soundbook MK2)
TEDS nach IEEE P1451:	yes
Max. electr. measuring range:	$\pm$ 10 V_{peak} (+8 % overload backup)
U_{max} at input:	$\pm$30 V_{peak}
Inherent noise level (at 0 dB gain):	<6 dB(A), <8 dB(C), <15 dB(Z) (using MV203 and substitute impedance K65), <3 dB(A), <2 dB(C), <5 dB(Z) bei 50 Ω direct at input
Linearity range:	See table 2.3
Impulse range:	> 55 dB
Sampling rate level/1/3 octave values:	5 . . . 125 ms (higher values possible, but without FAST weighting)
Slow input channels	
Quantity:	8 single-ended or 4 differential
Sampling rate:	200 Hz per channel
Input voltage:	$\pm$ 27.5 V
Input impedance:	100 kΩ
Inputs Trigger/Tacho (2)	
Frequency:	0.1 Hz . . . 6 MHz
Trigger level:	adjustable $\pm$ 12.5 V
Trigger outputs	2
Output channels (2)	
Sampling rate:	25.6, 51.2 kHz
Band width:	DC . . . 20 kHz
Max. output voltage:	$\pm$ 3.7 V_{peak}
Attenuation:	0 dB . . . 85 dB in 0.5 dB-steps
Connectors	
Input channels:	see section 1.1
Slow input channels:	see section 1.1
Outputs:	see section 1.1
Dimensions and weights APOLLO box	

Dimensions:	214 mm, 110 mm, 35 mm
Weight:	ca. 800 g
Dimensions and weights APOLLO EXPANDER	
Dimensions:	220 mm, 260 mm, 27 mm
Weight:	ca. 1260 g
Surrounding conditions	
Temperature:	Deviation of calibration < 0,3 dB within a temperature range of -20 °C to 50 °C at a relative humidity of 65 %. After temperature changes of more than 15 °C allow the analyzer to adjust to the temperature for 30 min.
Storage conditions:	-20 °C . . . +60 °C, humidity max. 95 %

Table 2.1:Technical Specification APOLLO

2.1 Frequency weightings

The following table shows the characteristics (filter curve) for the A- and C-weightings according to IEC 60651 / 60804. The last three columns contain the filter curves in APOLLO (measured at a gain of -20 dB).

f in Hz	A acc. to 60651	C acc. to 60651	A	C	Z
10	-70.0	-14.3	-69.52	-14.36	-0.04
12.5	-63.4	-11.2	-63.40	-11.36	-0.03
16	-56.7	-8.5	-56.40	-8.44	-0.01
20	-50.5	-6.2	-50.42	-6.25	-0.03
25	-44.7	-4.4	-44.86	-4.48	-0.04
31.5	-39.4	-3.0	-39.54	-3.04	0.00
40	-34.6	-2.0	-34.55	-1.99	-0.01
50	-30.2	-1.3	-30.29	-1.31	-0.01
63	-26.2	-0.8	-26.23	-0.83	0.00
80	-22.5	-0.5	-22.38	-0.47	0.03
100	-19.1	-0.3	-19.12	-0.28	0.02
125	-16.1	-0.2	-16.19	-0.17	0.01
160	-13.4	-0.1	-13.23	-0.06	0.02
200	-10.9	0	-10.85	-0.03	0.00
250	-8.6	0	-8.69	-0.01	-0.01
315	-6.6	0	-6.63	0.03	0.02
400	-4.8	0	-4.77	0.03	0.01
500	-3.2	0	-3.25	0.03	0.00
630	-1.9	0	-1.91	0.03	0.00
800	-0.8	0	-0.77	0.05	0.03
1.0k	0	0	0.03	0.03	0.03
1.25k	0.6	0	0.58	-0.03	0.00
1.6k	1.0	-0.1	1.01	-0.08	0.01
2.0k	1.2	-0.2	1.20	-0.17	-0.01
2.50k	1.3	-0.3	1.27	-0.3	-0.02
3.15k	1.2	-0.5	1.23	-0.48	0.01
4.0k	1.0	-0.8	1.00	-0.81	0.00
5.0k	0.5	-1.3	0.61	-1.26	-0.01
6.3k	-0.1	-2.0	-0.04	-1.96	0.00
8.0k	-1.1	-3.0	-1.02	-2.98	0.02
10.0k	-2.5	-4.4	-2.36	-4.35	0.02
12.5k	-4.3	-6.2	-4.17	-6.18	0.00
16.0k	-6.6	-8.5	-6.68	-8.69	0.01
20.0k	-9.3	-11.2	-9.25	-11.23	-0.01

Table 2.2: frequency weighting curves IEC 60651/60804 and APOLLO (dB)

2.2 Linearity ranges

The linearity ranges of sound pressure levels for all measuring ranges and frequency weightings are given in the following. All specifications refer to approved measurement microphones with a sensitivity of 50 mV/Pa.

Range	Weighting	f=31.5 Hz	f=1 kHz	f=4 kHz	f=8 kHz	f=12.5 kHz
1 V	Z	18.4 . . . 120.0 dB	18.8 . . . 120.0 dB	18.7 . . . 120.0 dB	18.8 . . . 120.0 dB	18.6 . . . 120.0 dB
	A	14.4 . . . 79.3 dB	14.7 . . . 120.0 dB	14.4 . . . 121.0 dB	13.8 . . . 118.8 dB	14.0 . . . 115.6 dB
	C	15.6 . . . 117.0 dB	15.0 . . . 120.0 dB	14.9 . . . 119.0 dB	15.2 . . . 117.0 dB	15.0 . . . 113.7 dB
10 V	Z	37.9 . . . 140.0 dB	38.5 . . . 140.0 dB	38.6 . . . 140.0 dB	38.7 . . . 140.0 dB	38.3 . . . 140.0 dB
	A	34.6 . . . 99.3 dB	36.1 . . . 140.0 dB	35.9 . . . 141.0 dB	35.7 . . . 138.8 dB	35.0 . . . 135.6 dB
	C	35.0 . . . 136.9 dB	35.2 . . . 140.0 dB	35.3 . . . 139.2 dB	35.0 . . . 137.0 dB	34.3 . . . 133.7 dB

Table 2.3: Linearity ranges (typical) for Soundbook MK2 according to frequency weightings Z, A and C

3 Declaration of conformity

We, the **SINUS Messtechnik GmbH**, Föpplstraße 13, 04347 Leipzig, Germany, hereby declare that our product

Measuring system APOLLO

Part number.: 90820x
Serial number: #07000

as subject of this **CE** declaration complies with the following standards and further documents:

Technical requirements	Sound level meter:	IEC 61672 (10/2003) class 1
with appropriate software		DIN 45657 (07/1997)
	Third-octave analyzer:	IEC 61260 (09/2001) class 1
	HVMA option:	EN ISO 8041 type 1
		EN ISO 5349
		EN 14253
Electromagnetic compatibility:	Emissions	DIN EN 61000-6-1: 2007
		IEC 61672-1
	Immunity	DIN EN 61000-6-2: 2007
		IEC 61326
		IEC 61672-1
Safety		EN 60950-1

The measuring system is intended for the use with measuring microphones according to IEC 1094-1. The product has been manufactured and tested in compliance with the following internal documents:

Manufacturing and testing documents:	- SINUS Quality assurance manual
	- SINUS Manufacturing documents Soundbook
	- Testing regulations Soundbook

The product has been tested and found to comply with all specifications stated above.

Gunther Papsdorf
Managing Director